13 March 2015.

**The Proposed IUPAP Commission on Accelerator Science**

Roy Rubinstein

Fermilab

1. Introduction

Discussions among accelerator scientists regarding a possible IUPAP Commission for their field have been ongoing for several years. In October 2014, the US Liaison Committee of IUPAP submitted a draft resolution (Attachment I) to the 2014 IUPAP General Assembly to form a new IUPAP Commission on Accelerator Science.

The resolution was discussed at the IUPAP General Assembly, held in Singapore on 5-7 November 2014. Several delegates (although not all) who commented on the proposal were very supportive. In the discussion, members of the IUPAP Executive Council noted that forming a new IUPAP Commission is very rare, but if there is strong support, it is sometimes preceded by the formation of an IUPAP Working Group. It was also noted that IUPAP already has a Working Group focused on accelerator science, namely its Working Group 1, the International Committee for Future Accelerators (ICFA).

This writer was asked by the General Assembly to see what consensus could be reached in the accelerator science community on a new IUPAP Working Group.

1. ICFA

ICFA was founded in 1976 under IUPAP Commission 11 (Particles and Fields) to promote international collaboration in all phases of the construction and exploitation of very high energy accelerators. For many years ICFA was IUPAP’s only Working Group. With the encouragement of past IUPAP Presidents, it served as a model for new IUPAP Working Groups when these were formed in the 1990s and 2000s.

Although energy-frontier particle physics accelerators and their utilization have been the major focus of ICFA, it has also been active in other accelerator fields. ICFA has long-term panels of experts on several topics such as accelerator beam dynamics (including the beam dynamics of synchrotron light sources and high intensity lower-energy accelerators); advanced and novel accelerators (concentrating on wakefield particle acceleration); and a joint effort with IUPAP Working Group 9 (International Committee on Ultra Intense Lasers) to study laser acceleration of particles.

1. Ascertaining Community Views on a New Working Group

In early December 2014, this writer emailed (Attachment II) the following organizations asking for their views:

IUPAP:

C10 (Structure and Dynamics of Condensed Matter); C11 (Particles and Fields); C12 (Nuclear Physics); C16 (Plasma Physics); AC4 (International Commission on Medical Physics); WG1 (International Committee for Future Accelerators); WG7 (International Committee on Ultrahigh Intensity Lasers); WG9 (International Cooperation in Nuclear Physics).

Also: International Particle Accelerator Conference; American Physical Society, Division of Physics of Beams (DPB). In addition conversations on this topic were held with some prominent accelerator physicists in Illinois, USA.

Replies were received from C10, C11, C12, WG9, ACFA (Asian Committee on Future Accelerators), and DPB, either on behalf of those organizations or the personal views of the organization official replying; most were strongly supportive of a new IUPAP Working Group. There was also extensive discussion of the proposed Working Group at ICFA meetings in October 2014 and February 2015.

1. Some Quotes from the Replies

**C12**

The IUPAP WG on Accelerator Science (AS) should be all encompassing and go much beyond what ICFA is doing for High energy physics. In principle it should be nearly orthogonal to ICFA since the major composition of ICFA is based upon the world large scale accelerator lab directors, while the new WG (eventually Commission) on AS should be formed based on a bottom up approach.

The WG on AS would touch fields like nuclear sciences, condensed matter, biology (XFEL, Synchrotron radiation, neutron facilities....), medical isotopes, medical imaging (PET,X-Rays etc), plasma sciences, Space irradiation, computing simulation tools etc etc.

There are also about 12,000 accelerators used in industry as well.

**ACFA**

In most of Asian countries, accelerator community is represented by photon science, not by HEP.

**WG9**

Enthusiasm for the idea from the HEP, ONP, and BES people at BNL who are involved in accelerator work at the RHIC/AGS complex, the new NSLS-II, and the HEP ATF

**DPB**

A new IUPAP Commission or Working Group is a good idea because it will strengthen the field of accelerator science in IUPAP; he did not realize that ICFA had an association with IUPAP. The feeling among many non-HEP accelerator scientists is that ICFA’s primary focus is on the construction and strategy of HEP accelerators. To really broaden ICFA to encompass non-HEP accelerator interests would be a big culture change for ICFA.

1. Summary

The accelerator field has changed in the past four decades since ICFA was formed in an era when the field was dominated by the needs of frontier particle physics. There are now over 10,000 accelerators worldwide, and only a handful of these are used for frontier particle physics; most are used in medicine, industry, and neutron sources and synchrotron light sources used significantly for biological and solid state physics research. It is accelerator scientists working in these new areas that would be represented by a new IUPAP Working Group

Also, ICFA realizes that for it to become a body representing all of accelerator science would mean losing its focus on frontier particle physics accelerators and the particle physics that is carried out using them; these accelerators still drive many of the advances in the accelerator field, and these advances subsequently are incorporated into the broader accelerator community.

It appears to this writer that the support for a new IUPAP Working Group on Accelerator Science is broad among the large non-particle physics accelerator community and that this physics community feels that it is not represented in IUPAP; it also feels that ICFA is too particle physics-centric to represent its interests.

1. Recommendations

This writer believes that IUPAP should allow the formation of a new IUPAP Working Group on Accelerator Science, subject to an appropriate mandate being produced. If it does come into existence, it should have a strong connection with ICFA, including representatives of each invited to meetings of the other. Since ICFA has sub-units which work on aspects of accelerator science broader than just frontier energy accelerators, there must be significant efforts made to avoid duplication of these existing activities.

ATTACHMENT I

DRAFT RESOLUTION of the XXVIIIth General Assembly of IUPAP to form a new IUPAP Commission on Accelerator Science. (presented by the United States Liaison Committee of IUPAP)

WHEREAS the science of accelerators is rich and challenging. Particle beams are many- body systems with non-isotropic, non-thermal distribution, exhibiting many collective instabilities and self-organizing phenomena when interacting with electromagnetic fields and plasmas. Accelerator Science uses a rich assortment of concepts, devices and materials to accelerate and diagnose beams. Accelerator Science impacts and advances many branches of science such as materials science, nuclear science, and elementary particle science, as well as commercial, medical and environmental applications, and

WHEREAS international collaboration is common in Accelerator Science, as is indicated by large international conferences (*e.g*. IPAC) and large and small projects (*e.g*. LHC,

neutron and photon sources) worldwide, and

WHEREAS Accelerator Science is not currently represented in IUPAP as its own discipline. The C11 Commission on Particles and Fields’ mission includes the support for the exchange of information on accelerators used in particle physics, and C11 has endorsed the annual International Particle Accelerator Conference series that was initiated by the international accelerator science community in 2010, and

WHEREAS the IUPAP working group, International Committee for Future Accelerators (ICFA), has served as a forum for accelerator facilities to work together to facilitate international collaborations in the construction and use of accelerators for high energy physics. The IUPAP working group (WG9) International Cooperation in Nuclear Physics (ICNP) maintains a compendium of Nuclear Physics facilities worldwide, and

WHEREAS the use of accelerators in research extends to many other fields and applications, it is time to acknowledge Accelerator Science as a cross cutting field of physics.

Therefore the XXVIIIth General Assembly of IUPAP this VIIth day of November, 2014, resolves to do the following:

1. Create a new IUPAP commission dedicated to Accelerator Science.
2. Set the mission of the IUPAP Accelerator Science Commission to promote the exchange of information and views among the members of the international scientific community in the general field of Accelerator Science including, but not limited to, the following:
	1. the theory and experiments concerned with the nature and properties of particle accelerators and beam physics;
3. the improvement of international communications in Accelerator Science through the sponsorship of professional meetings;
4. the future of accelerator facilities for various fields that benefit science and society;
5. the industrial, medical, energy production and environmental applications of relevant accelerator technologies.

ATTACHMENT II

**From:** Roy Rubinstein
**Sent:** Tuesday, December 02, 2014 10:36 AM
**To:** 'y\_fujii@cross.or.jp'; 'hidesakai@riken.jp'; 'bob.bingham@stfc.ac.uk'; 'kycheung@hksh.com'; 'toshiki.tajima@physik.uni-muenchen.de'; 'rtribble@bnl.gov'; Stuart Henderson; Juan Fuster Verdu; Joachim Mnich; 'andrew@jlab.org'
**Cc:** Patty McBride; 'cecilia.jarlskog@matfys.lth.se'; 'bhjmckellar@mac.com'
**Subject:** IUPAP and accelerator science

To: IUPAP Commissions and Working Groups and other entities that may have an interest in accelerator science

Dear Colleague,

                          As you may know, at the recent IUPAP General Assembly (GA) a draft resolution was presented by the US IUPAP Liaison Committee to form a new IUPAP Commission on Accelerator Science (see attached). In the GA discussion, it was commented that forming a new IUPAP Commission is very rare, but if there is strong support, it is sometimes preceded by the formation of an IUPAP Working Group. It was also commented that IUPAP already has a Working Group concerned with accelerator science, namely its Working Group 1, the International Committee for Future Accelerators (ICFA)—see:

<http://www.fnal.gov/directorate/icfa/index.html>

At the GA, I was asked to see what consensus can be reached, so I’m writing to ask if you/your organization have any views on this topic; if so I would appreciate any comments by 10 January 2015. Also, could you let me know if you think a meeting of representatives of interested parties would be useful?

                Best wishes,

                   Roy Rubinstein.

This message sent to:

IUPAP

C10 (Structure and Dynamics of Condensed Matter)

C11 (Particles and Fields)

C12 (Nuclear Physics)

C16 (Plasma Physics)

AC4 (International Commission on Medical Physics)

WG1 (International Committee for Future Accelerators)

WG7 (International Committee on Ultrahigh Intensity Lasers)

WG9 (International Cooperation in Nuclear Physics)

International Particle Accelerator Conference

American Physical Society, Division of Physics of Beams